



Chapter 3

The Refuge Environment

Geographic/Ecosystem Setting

The Lower Missouri River Ecosystem

The U.S. Fish and Wildlife Service has implemented an ecosystem approach to fish and wildlife conservation. Under this approach the Service's goal is to contribute to the effective conservation of natural biological diversity through perpetuation of dynamic, healthy ecosystems by using an interdisciplinary, coordinated strategy to integrate the expertise and resources of all stakeholders. Figure 2 displays the eight ecosystems within the Service's Region 3.

DeSoto National Wildlife Refuge lies within the Lower Missouri River Ecosystem and astraddle the river itself. The physical and chemical characteristics of the river have significant influences on the management of DeSoto's floodplain lands. (See Figure 3, p. 36.)

The Missouri River is the nation's second longest, flowing 2,250 miles through seven states from the Rocky Mountains to the Mississippi, and draining one-sixth of the land mass of the contiguous United States. At the time of the Lewis and Clark Expedition two centuries ago (1804-1806), the Missouri floodplain was a diverse 2,300-mile-long ecosystem that included braided channels, riparian lands, chutes, sloughs, islands, sandbars, and backwaters. The dynamic "Big Muddy" (so dubbed because of its high sediment load) continually reshaped its channel and floodplain through a never-ending process of creation and destruction, deposition and erosion. The Missouri River was a complex natural system supporting an extraordinary diversity of fish, wildlife, and plants.

".....from the Bluff on the 2d rise immediately above our Camp, the most butifull prospect of the River up & Down and the Countrey Opsd. prosentet it Self which I ever beheld; The River meandering the open and butifull Plains, interspersed with Groves of timber, and each point Covered with Tall timber..."

--*The Journals of Lewis and Clark*
Monday, July 30, 1804

It flooded annually, on a cycle that typically included a March/April rise caused by rain and melting snow on the Great Plains and a higher June flood pulse, when the Missouri filled with runoff from Rocky Mountain snow-melt. In summer and fall the river discharge declined, reaching a low point in late December. Fall rains sometimes prompted a slight rise in October or November. This rise and fall, and the resulting deposition within the floodplain, created some of the country's best wetland and bottomland habitats, along with potentially productive agricultural lands.

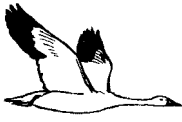


Figure 2 inserted here



The importance and potential of the Missouri River as a navigation channel was first recognized by early American explorers. By the mid-1800's, the river was already heavily traveled by steamboats and keelboats. As demand for commercial transportation grew in the second half of the 19th century, so did demand to “tame” the river by removing woody debris, snags and other hazards to boat traffic. The first half of the 20th century was marked by intensive channelization of the river and the beginning of reservoir construction, including six major flood control dams in the Missouri’s upper reaches. These dams did indeed help reduce flooding, but in so doing, altered the natural flood cycle on which the ecosystem depended.

“When Lewis and Clark traveled up the Missouri in 1804 on their way to the West Coast, the river was varied and dynamic, with caving banks, snag-filled side channels and thousands of sandbars and islands. It teemed with life.

“For the better part of two centuries, however, the government’s engineers have transformed much of the muddy, free-flowing Missouri into little more than a barge canal and a series of slackwater reservoirs. The river Lewis and Clark knew is mostly lost.”

— Stephen Ambrose, author of *Undaunted Courage: Meriwether Lewis, Thomas Jefferson, and the Opening of the American West*;
“Save the Missouri River,” *Omaha Sunday World-Herald*, February 6, 2000

Vestiges of this history of engineering/navigation works are visible even today from DeSoto’s Visitor Center windows in the form of piling dikes protruding from the shores of DeSoto Lake. These durable bald cypress pilings were placed there from 1935 to 1942 by the Army Corps of Engineers to accrete land where the river had spread out, in other words, to narrow and deepen the channel. The project ceased during World War II and did not resume after the Missouri’s enormous 1952 flood. The 1944 Flood Control Act (Pick-Sloan) and the Missouri River Bank Stabilization and Navigation Project were intended to control erosion and protect land along the river. These and other projects eventually converted the Missouri from a free-flowing river into a series of reservoirs and channelized waterways, effectively separating the river from its floodplain. By 1972, the river’s length had been shortened by 46 miles and its surface water area decreased from 121,739 acres to 71,151 acres. River flows have been changed primarily to enhance flood control and navigation and to provide hydroelectric power. Normal flow patterns are reversed at dams, where high flows in the spring are suppressed, and low summer and fall flows augmented (USFWS, “Lower Missouri River Ecosystem,” at www.fws.gov/r3pao/ecosys/lowmiss.htm).

This vast engineering program has had devastating impacts on fish and wildlife populations and habitat. Roughly 168,000 acres of natural channel and 354,000 acres of associated habitat have been lost on the lower 730 miles of river. This acreage became accreted lands on which agricultural and industrial development occurred. Shallow water habitats, essential to fish spawning and rearing of young, have been reduced by 90 percent in some areas. In addition, islands and sandbars, important nesting habitat for migratory birds and other species, have been virtually eliminated. Moreover, riparian forest habitat was reduced from 76 percent of floodplain vegetation in the 19th century to just 13 percent by 1972 (USFWS, “Lower Missouri River Ecosystem”).



In addition to extensive habitat modification along the river and within the larger watershed, chemical contamination has emerged as an issue in the last half-century. With nearly 95 percent of the drainage basin's land area dedicated to agriculture, non-point sources are a major contributor to pollution along the river and its floodplain. Erosion of farmland soils as well as direct rainfall runoff can introduce fertilizers and a variety of pesticides into the bottomland ecosystem. These substances may be toxic both through direct exposure as well as through bioaccumulation in the food chain with secondary effects on reproduction and behavior. For example, DDT and its breakdown products DDD and DDE, thin eggshells. (Because of their persistence in the environment, and the potential for bioaccumulation, the use of many organochlorine pesticides like DDT has been banned in the U.S.) Over the years, periodic monitoring by the Fish and Wildlife Service detected these synthetic organic toxins at significant concentrations in Missouri River fish. For banned chemicals, these levels have tended to decline as background residues diminish. Toxic heavy metals such as mercury, selenium, copper, and cadmium in sediments and fauna of the Missouri River and its tributaries have also been documented over the years. High concentrations of heavy metals alter metabolic processes in plants and animals, leading to reduced survival. Past mining activities, industrial discharges and natural occurrences have been identified as sources of these heavy metals.

As well as non-point sources of pollution, there are also numerous “point” sources along the Missouri and its tributaries regulated by National Pollutant Discharge Elimination System (NPDES) permits administered by the U.S. Environmental Protection Agency and state regulatory agencies. NPDES permits must be obtained by publicly-owned sewage treatment facilities and private industrial discharges. Many pipelines carrying natural gas, crude oil and petroleum products traverse the river and its tributaries. In 1988 and 1990 the potential for pipeline breaks was realized with two actual ruptures releasing petroleum products into tributaries which ultimately ended up in the Missouri River. There is also the potential for spills or releases of hazardous waste from transportation vehicles such as barges, trucks and trains. Superfund sites and other uncontrolled hazardous waste sites found within the river's floodplain could contribute to the contamination of the river waters during a flood.



Bald eagle
credit: Mike Lockart, USFWS

The potent combination of these physical and chemical changes to the river, its floodplain, and its watershed have taken a heavy toll on native plants and animals. Five species of plants and seven species of wildlife found in the lower Missouri River ecosystem are considered Federally endangered or threatened. These are the decurrent false aster, Mead's milkweed, Missouri bladderpod, prairie bush-clover, western prairie fringed orchid, bald eagle, least tern, piping plover, Indiana bat, pallid sturgeon, Niangua darter, and pink mucket pearlymussel. Two other species — the sturgeon chub and the sicklefin chub — are



candidates for Federal listing. Numerous other species are rare or declining enough to cause concern. Many fish species native to the river are experiencing serious population declines. Information from some parts of the river indicates long-term declines in productivity of commercial and some sport fisheries, along with the invertebrates that sustain many aquatic species.

In recent years, Federal and state agencies have begun cooperating to rehabilitate those elements of the Lower Missouri ecosystem most amenable to restoration, such as backwater sloughs, unprotected partials of floodplain, and riparian remnants. Ironically, these efforts were given a boost by the back-to-back, highly destructive floods of 1993 and 1995. Although moderate to large floods along the Missouri have mostly been controlled, catastrophic floods have not. Unusual conditions in those years coincided to raise the river to levels never before recorded, causing levee breaks, massive damage to crops and property, and significant loss of life (38 dead in 1993). These tragedies led many landowners to consider selling their land to state and Federal agencies for uses that would not be impacted by future flooding, such as wildlife refuges or conservation areas.

While it is impractical in this day and age to dream of restoring the Missouri River to a pristine condition, much can still be done to substantially improve its value for native flora and fauna. Upcoming restoration efforts will probably entail a combination of re-establishing natural flood pulses and reconnecting the river to its floodplain in places where parcels of land can be acquired from willing sellers. This is already happening at the Service's newly established Big Muddy National Fish and Wildlife Refuge. This refuge consists of small tracts of land along the river from Kansas City to St. Louis where flooding, scouring, and deposition have been detrimental to agriculture but beneficial to wildlife and natural habitats.

DeSoto Refuge also represents an opportunity to re-establish floodplain habitats such as woodlands, grasslands and wetlands.

Migratory Bird Conservation Initiatives

Partners in Flight

Nationally and internationally, several nongame bird initiatives are in the planning stage, with implementation beginning in the near future. Partners In Flight (PIF) / *Compañeros en Vuelo* / *Partenaires d'Envol* is an international initiative launched in 1990 in response to growing concern about population declines of many land bird species, and in order to emphasize the conservation of birds not covered by existing initiatives and treaties. The initial focus was on species that breed in the Nearctic (North America) and winter in the Neotropics (Central and South America); the focus has expanded to encompass most landbirds and other species requiring terrestrial habitats.

The central premise of PIF is that the resources of public and private organizations in North and



South America must be combined, coordinated, and increased in order to achieve success in conserving bird populations in this hemisphere. PIF is a cooperative effort involving partnerships among federal, state and local government agencies, philanthropic foundations, professional organizations, conservation groups, industry, the academic community, and private individuals. Currently partners include 16 federal agencies, 40 non-governmental organizations (NGO's), over 60 state and provincial fish and wildlife agencies, numerous universities, and the forest industry.

PIF is developing Bird Conservation Plans, primarily for landbirds, in numerous physiographic areas. The plans include priority species lists, associated habitats, and management strategies. The same elements will be byproducts of ongoing planning efforts for shorebirds (U.S. Shorebird Conservation Plan) and colonial waterbirds (North American Colonial Waterbird Conservation Plan). As the plans are finalized, DeSoto NWR will strive to implement conservation strategies outlined in these plans to the extent possible and practical.

DeSoto NWR lies within PIF Physiographic Area #32, Dissected Till Plains. Species priorities for this area can be found at <http://www.cbobirds.org/pif/physios/32.html>. PIF has designated Important Bird Areas that include a number of refuges. Likewise, the Western Hemisphere Reserve Network includes several refuges.

A goal of Partners in Flight is to integrate all migratory bird conservation programs under the umbrella of the North American Bird Conservation Initiative. This is a continental effort to have all migratory bird initiatives operate under common Bird Conservation Regions, and for implementers to consider the conservation objectives of all birds together to optimize the effectiveness of management strategies.

North American Waterfowl Management Plan

The North American Waterfowl Management Plan (NAWMP), signed in 1986, outlines a broad framework for waterfowl management strategies and conservation efforts in the United States, Canada, and Mexico. The goal of the NAWMP is to restore waterfowl populations to historic levels. The NAWMP is designed to reach its objectives through key joint venture areas, species joint ventures, and state implementation plans within these joint ventures.

The Fish and Wildlife Service has made major contributions to the



DeSoto staff banding Canada geese
credit: Bruce E. Weber



habitat conservation goals of NAWMP through its Waterfowl Production Area program and basic acquisition program. Waterfowl Production Areas are wetlands with upland buffers for nesting habitat that are generally small in acreage and sometimes include water control structures. They are open to hunting.

NAWMP is innovative because it is international in scope yet is implemented at the regional level. Its success depends on partnerships involving federal, state, provincial, and local governments, businesses, conservation organizations, and individual citizens, called joint ventures. Joint ventures develop implementation plans focusing on areas of concern identified in the Management Plan. NAWMP partners not only advance waterfowl conservation, but make substantial contributions toward the conservation of all wetland-dependent species.

In 1994 and again in 1998 NAWMP was updated and habitat goals expanded. In 1986, Plan goals were to protect and restore some 6 million acres of wetlands habitat. The 1998 Plan update called for 12.2 million acres of wetlands and associated uplands to be protected and 15.2 million acres to be restored and enhanced. The goal of restoring continental waterfowl populations to numbers seen in the 1970s remains essentially unchanged.

The Lower Missouri ecosystem and DeSoto National Wildlife Refuge are situated within the Upper Mississippi River and Great Lakes Region Joint Venture. This Joint Venture updated its implementation plan in 1998, expanding partnerships into 10 upper Midwest states and revising its habitat and population objectives to include migrating waterfowl and non-game migratory birds. Due in large part to conservation activities associated with projects funded through the North American Wetlands Conservation Act, Joint Venture partners were able to conserve over 60,000 acres of habitat in 1998.

Even though there are no specific NAWMP projects on DeSoto Refuge, waterfowl visiting the refuge may very well be the beneficiaries of projects elsewhere in the flyway.

Arctic Goose Management Initiative

Excessive numbers of the mid-continent population of snow geese are causing widespread damage to Arctic habitats used by these geese and other wildlife. For two decades, this population has been expanding rapidly, at an average rate of about 5% per year. The major cause of this sustained (but not sustainable) population growth is improved winter survival and recruitment brought about by a virtually unlimited food supply. Food is now essentially unlimited due to the expansion and productivity of modern agriculture in the Midwestern landscape and the availability of sanctuaries and refuges. Snow geese have effectively been released from their former winter carrying capacity restraints and now exceed the carrying capacity of their summer breeding grounds in northern Canada.

Barring management intervention to reduce the size of the mid-continent snow goose population, over-grazing and over-grubbing will continue to severely – and perhaps irreversibly – degrade plant community structure in the Arctic tundra ecosystem. Over-exploitation leads to increases in soil salinity which can impede recovery of formerly dominant species. Plant communities



associated with goose breeding are finite in area and distribution.

In 1997, the Arctic Goose Habitat Working Group recommended the formation of an Arctic Goose Management Initiative overseen by the Arctic Goose Joint Venture of the North American Waterfowl Management Plan. The Working Group also recommended that the mid-continent snow goose population be reduced by 5-15% annually for the foreseeable future, primarily through more liberal hunting regulations to allow increased harvest. Finally, the Working Group recommended that additional hunting be allowed in and near state, provincial and federal wildlife refuges.

Responding to this initiative, in 1999 DeSoto managers successfully sought authorization for a guided snow goose hunt, which opened in November. Approximately 60 geese were harvested. While the number of birds harvested by such a hunt will be a tiny fraction of the overall transitory population, hunting pressure on the refuge could also serve to disrupt and disperse the birds, forcing them to move to other areas where hunting can also occur. DeSoto managers recognize that the fall snow goose migration at the refuge is a magnificent natural spectacle that attracts many visitors to the refuge. While contributing to the crucial international effort to reduce snow goose numbers, precautions will be taken to avoid the undesirable outcome of driving them away from the refuge altogether.

Region 3 Fish & Wildlife Resource Conservation Priorities

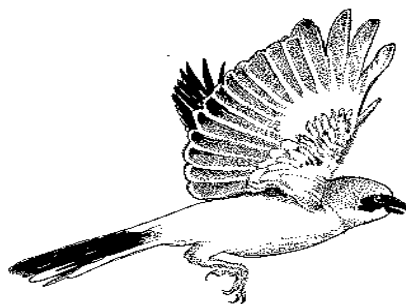
The Government Performance and Results Act (GPRA) of 1993 required the U.S. Fish and Wildlife Service to identify its most important functions and to direct its limited fiscal resources toward those functions. From 1997 to 1999 within Region 3, a group looked at how best to identify the most important functions of the Service within the region. The group recognized that the Service has a complex array of responsibilities specified by treaties, laws, executive orders, and judicial opinions that exceed the agency's budget.

The group recognized that at least two approaches are possible in identifying conservation priorities — habitats and species. The group chose to focus on species because (1) species represent biological and genetic resources that cannot be replaced, (2) a focus on species conservation requires a concurrent focus on habitat, and (3) by focusing on species assemblages and identifying areas where ecological needs come together the Service can select the few key places where limited efforts will have the greatest impact. Representatives of the migratory bird, endangered species, and fisheries programs in Region 3 identified the species that require the utmost attention given our current level of knowledge. Representatives prioritized the species based on biological status (endangered, threatened, for example), rare or declining levels, recreational or economic value, or "nuisance" level. The group pointed out that species not on the prioritized list are important too. But, when faced with the needs of several species, the Service should emphasize the species on the priority list.



The following priority species, identified by the U.S. Fish and Wildlife Service as threatened or endangered, rare or declining, have been recorded at DeSoto NWR:

- C Bald eagle
- C Piping plover
- C American woodcock
- C Least tern
- C Loggerhead shrike
- C Wood thrush
- C Grasshopper sparrow
- C Henslow's sparrow
- C Dickcissel
- C Bobolink
- C Eastern meadowlark



Loggerhead shrike
credit: Robert Savannah

The ecosystem context, the over-arching conservation programs, state listed species, and the regional resource conservation priorities were considered in the preparation of this Comprehensive Conservation Plan.

Refuge Resources, Cultural Values and Uses

General

Surrounded by a landscape dedicated primarily to growing corn and soybeans, DeSoto National Wildlife Refuge is dedicated to managing semi-natural habitat for the benefit of waterfowl and other wildlife. With its unique Steamboat *Bertrand* Collection, it is also a place “where wildlife and history meet.” Each autumn the refuge hosts hundreds of thousands of migratory waterfowl, particularly snow geese but many other species as well, on their way south for the winter. This marvelous natural spectacle draws many thousands of visitors locally and from across the country. The refuge also boasts DeSoto Lake, a 7-mile long oxbow lake that provides boating, fishing, and wildlife viewing opportunities. The Missouri River itself bisects the refuge. DeSoto embraces a diversity of habitats, including riparian or floodplain woodlands, managed native grasslands, wetlands, and low-input croplands on a “biological rotation.”

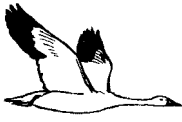
Climate

The climate of DeSoto National Wildlife Refuge is characteristic of mid-latitude, mid-continental regions. Annual precipitation (rainfall and snowfall combined) is approximately 30 inches; average snowfall is

“...living in Nebraska is like putting your right foot in a bucket of cold water and your left foot in a bucket of warm water, then it all averages out to normal.”

--Laurie Niles

Omaha World-Herald, January 7, 1996



29.5 inches. As typical of areas with continental climates, there are wide temperature fluctuations between the seasons. Summers are hot and winters are quite cold with sub-zero weather not unusual. January maximum temperatures average in the upper twenties, and minimums about ten degrees Fahrenheit. July maximums average about ninety and minimums in the mid-sixties.

Geology, Hydrology and Soils

DeSoto NWR is situated entirely within the historic floodplain of the Missouri River. A floodplain is the area of flat ground alongside a river that is inundated by floods. Although the refuge is now separated from the river by a levee, DeSoto's landforms, its soils and its oxbow lake are all a direct result of the natural fluvial processes of meandering, deposition and scouring carried out by the Missouri for countless eons.

The Missouri is the greatest of the rivers draining the eastern slopes of the Rocky Mountains and crossing the Great Plains toward its rendezvous with the Mississippi. Like all rivers traversing the gentle gradients of lowlands, the lower Missouri meandered, that is, its sinuous channel shifted back and forth across its floodplain over time, forming an ever-changing panorama of loops, curves, bends, and oxbows. As the river flowed, any curve or meander in its course was accentuated by the current. On the outside of the curves the water velocity of the current was greatest, and therefore the erosion it caused as it swept around the outer bend was also greatest. The Missouri would undercut the outside bank, scouring and carrying away earth. On the curve's inside, the current was slow and it deposited any transported material, building up a gentle slip-off slope.

As each meander migrated outward, the river gradually changed its course across the floodplain. A loop in the Missouri's path could become so circuitous, so far away from the shortest, most direct route that it would eventually be cut off from the main channel, usually in a flood, forming an oxbow lake. DeSoto Bend was a long loop in the Missouri River that was well on its way to being pinched off into an oxbow lake at some point in the future. But engineers eager to control the unruly river beat nature to it, excavating a new cutoff channel and building a levee to create DeSoto Lake in 1960. The formerly dynamic, erratic Missouri River now wears what amounts to a straight-jacket that controls most but not all of its "mood swings," as witnessed by the dramatic floods of 1993 and 1995.

As a consequence of the historic cycle of annual floods as well as the Missouri's tendency to carve new river channels, DeSoto Refuge soils were formed from coarse to fine-textured recent alluvium (river-deposited sediments). These soils are generally low to moderate in organic matter, calcareous, ranging from neutral to moderately alkaline. Available phosphorus is generally low, while the supply of available potassium is generally high. Permeability (ability of water to percolate through) ranges from rapid to slow. In some areas, clays and loams form the upper layer of the soil and are underlain by fine sand and sandy loams. Loams are generally fertile soils, usually containing a significant amount of organic matter.

Some areas on the refuge contain soils consisting entirely of clay, and some all of sand. Still



other sites have sandy loams over clay or clay loams. Most refuge fields do not have a consistent soil type from one end to the other, which makes management challenging.

Wetlands

The National Wetlands Inventory (NWI) is an extensive, ongoing survey by the U.S. Fish and Wildlife Service of aquatic habitats across the United States. The NWI is based on interpretation of aerial photographs, not ground surveys, and its criteria differ somewhat from those used in jurisdictional wetlands delineations for permitting by the U.S. Army Corps of Engineers under Section 404 of the Clean Water Act. The NWI has identified approximately 1,560 acres of 32 different types of wetlands on DeSoto Refuge. DeSoto Lake and the Missouri River together comprise about 60 percent of this total wetland acreage. Temporarily flooded riparian forests adjacent to the river are also included. (Due to the levees along the river banks these forests may no longer flood with any regularity.) At present, staff are actively managing 101 acres of marsh-like wetlands and moist soil units on the refuge.

Vegetation

Woodlands — It is likely that most of what is now DeSoto National Wildlife Refuge was once covered with bottomland forest, although the continual shifting and meandering of the river channel probably removed the forest cover periodically and maintained some areas in prairie grass. The common species described in this area by Lewis and Clark included cottonwood, oak, black walnut and hickory. The Missouri was then a meandering corridor of braided, sinuous channels, sandbars, backwaters, sloughs and marshlands, all connecting the river to its floodplain. Willows colonized bare islands and sandbars, to be succeeded by cottonwoods, which in the natural process of plant community succession were replaced by silver maple, boxelder, red mulberry and American elm. Beginning in the late 1800s, some lands in the river bottom were cleared for cropland. Other clearing for agriculture was conducted in the 1940s and 1950s. As recently as 1963-64, an additional 350 acres of DeSoto NWR were cleared for cropland.

Currently, DeSoto contains approximately 3,345 acres of riparian woodlands and brushlands. Cottonwood (*Populus deltoides*) is the predominant canopy tree in this forest type. Reaching 100 feet or more in height, it towers above all other trees in the floodplain. These stands were likely established when the Missouri River was actively flooding, scouring and depositing soils in natural processes that are no longer occurring on a regular basis. Today, in the absence of this dynamic force, proper conditions for the regeneration of cottonwood stands rarely occur.

The majority of the existing cottonwoods appear to be between 40 to 60 years of age and extensive mortality has been occurring in these stands for several years. Concerns have been raised regarding minimal regeneration of this species (at DeSoto and wherever else floodplains are no longer flooded). Old cottonwoods are currently being replaced by more shade-tolerant species that do not depend on flooding, such as hackberry (*Celtis occidentalis*), red mulberry



White-tailed buck in DeSoto bottomland forest

credit: John Jave

(*Morus rubra*), and green ash (*Fraxinus pennsylvanica*), which may result in improved mast (fruit and nut) production as these species become dominant. However, at the present time, the most obvious successional change is a dense midstory of roughleaf dogwood (*Cornus drummondii*), averaging 10-12 feet in height.

Other common trees of DeSoto Refuge's floodplain woodlands include black willow, sandbar willow, black walnut, boxelder, eastern red cedar, and the exotic Chinese elm.

Native Grasslands — The exact extent to which the lands that are now DeSoto Refuge were covered by native prairie grasslands (versus floodplain woodlands) prior to modern settlement and agriculture is unknown. What is known is that DeSoto now supports native grass species found in both the tallgrass and shortgrass prairie. The refuge is located in the zone of gradation between the two, with the true tallgrass prairie to the east and the shortgrass prairie further to the west. At present, managed grasslands dominated by native species occupy approximately 1640 acres at DeSoto in units scattered throughout the refuge.

The native grasses found at DeSoto NWR include:

- C Sideoats grama (*Bouteloua curtipendula*), an erect perennial that grows as tufts scattered among other grasses. It tends to replace taller grasses if overgrazing occurs.
- C Little bluestem (*Schizachyrium scoparium*), a perennial, is the dominant grass of the mid-grass prairie and the State Grass of Nebraska. This grass is found in sandy fields and its seeds are valuable to small birds in winter.
- C Switchgrass (*Panicum virgatum*), a perennial that grows easily on moist, sandy soil as well as drier sites and produces high hay yields.
- C Canada wild rye (*Elymus canadensis*), a perennial cool season grass found over most of North America and reaching four feet in height.



- C Big bluestem (*Andropogon gerardi*), a tall perennial known as the “king of native grasses” and the “prince of the prairie.” It can reach 6-8 feet in height, is relished by livestock; few prairie grasses equal it in forage quantity or quality.
- C Sand lovegrass (*Eragrostis trichodes*), a perennial distinguished by delicate seedheads with hundreds of tiny seeds. It grows best on sandy soils.
- C Eastern gamagrass (*Tripsacum dactyloides*), a stout perennial that reaches heights of up to 9 feet, and grows in large clumps up to four feet in diameter. Authorities believe it is related to corn.
- C Indiangrass (*Sorghastrum nutans*), a coarse perennial that is one of the dominant species of the tallgrass prairie. It may reach 6 feet or more when mature and has beautiful golden seed heads.
- C Buffalo grass (*Buchloe dactyloides*) is a low, creeping perennial that is an important forage species in the short grass prairie. It once sustained vast herds of buffalo.
- C Blue grama (*Bouteloua gracilis*) is a short bunch grass known as the “queen of the plains,” because of its excellent forage quality.

Other grasses used in seed mixes for grassland restoration include needlegrass, Virginia wildrye, and wheatgrass. Grass mixes are wet warm-season, mesic warm-season, sandy warm-season, and cool-season, depending on soil preference and planting time of year.

Croplands — At one time almost half the refuge was cultivated. The rationale for cropland was that it provided food and loafing areas for migrating waterfowl, and food, cover, and edge for other wildlife species. Since the 1970s the acreage devoted to cropland has gradually been reduced. At present approximately 1990 acres (about one-quarter) of the refuge are maintained in a low-input (minimal fertilizers and no insecticides) “biological rotation.” The principal crops are corn, soybeans, sweet clover, milo, alfalfa, and grass hay.

Fish and Wildlife

Birds, Mammals, Reptiles, Amphibians, and Other Wildlife — DeSoto NWR’s mosaic of habitats support a number of vertebrate species, which are listed in Appendix E. Although wildlife habitats and populations on the refuge have been drastically altered by human activities ranging from channelization of the Missouri River to agricultural cultivation, DeSoto still contains significant wildlife resources due to its proximity to the Missouri, its location along principal migratory flyways, and as a result of the Service’s management and conservation efforts.

In typical years, hundreds of thousands of snow geese utilize the refuge as a resting and feeding area during their fall migration between Arctic nesting grounds and Gulf Coast wintering areas. These spectacular concentrations are generally seen in November and December; smaller concentrations occur in March and early April. Such large gatherings of snow geese rarely occur elsewhere in Iowa or Nebraska; one other comparable congregation does take place on the Platte River in central Nebraska, during the spring northward migration. As discussed elsewhere, mid-continent snow geese populations have burgeoned in recent decades. Canada geese show up at DeSoto as well, though in much smaller numbers. Peak populations of 70,000 or more ducks,



Kestrel
credit: David Menke

mostly mallards, also utilize the refuge during fall migration. Peak duck populations are significantly down in recent years. Other species of ducks include the wood duck, green-winged teal, black duck, northern pintail, blue-winged teal, northern shoveler, gadwall, American widgeon, canvasback, redhead, ring-necked, greater and lesser scaups, common goldeneye, bufflehead, hooded merganser, common merganser, red-breasted merganser, and ruddy duck.

Each fall, numerous bald eagles follow the geese into the refuge and out of it again, as the migration proceeds south. Peak numbers of bald eagles usually occur in late November and December, and again in early March. As many as 143 have been observed at one time. Eagles are often found perched in cottonwoods along DeSoto Lake when waterfowl are present.

DeSoto's woods and fields attract a variety of songbirds, including neotropical migrants, and other resident wildlife. During migration periods, warblers, gulls, herons, and egrets abound. White pelicans and cormorants usually stop in the area for several weeks during their migrations. Owls, pheasants, and bobwhite

quail are common too, and remain on the refuge year around. Overall, almost 250 different avian species have been reported on the refuge.

Approximately 300 white-tailed deer make the refuge their home. Many local visitors drive the auto-tour loop at dusk to see the deer grazing in the fields. Other mammals found in woods and fields include cottontail rabbits, raccoons, skunks, badgers, coyotes, opossums, and fox squirrels. Coyotes are often seen resting on the ice-covered lake on sunny winter days. Backwater areas of DeSoto Lake and several wetlands serve as habitat for beaver, muskrat, and mink. Foxes, weasels and other animals also occur on the refuge. Overall, about 40 species of mammals have actually been identified on DeSoto, or are strongly suspected to be present, including two species of shrew, eight bats, eight carnivores, seventeen rodents, and two species of rabbits.

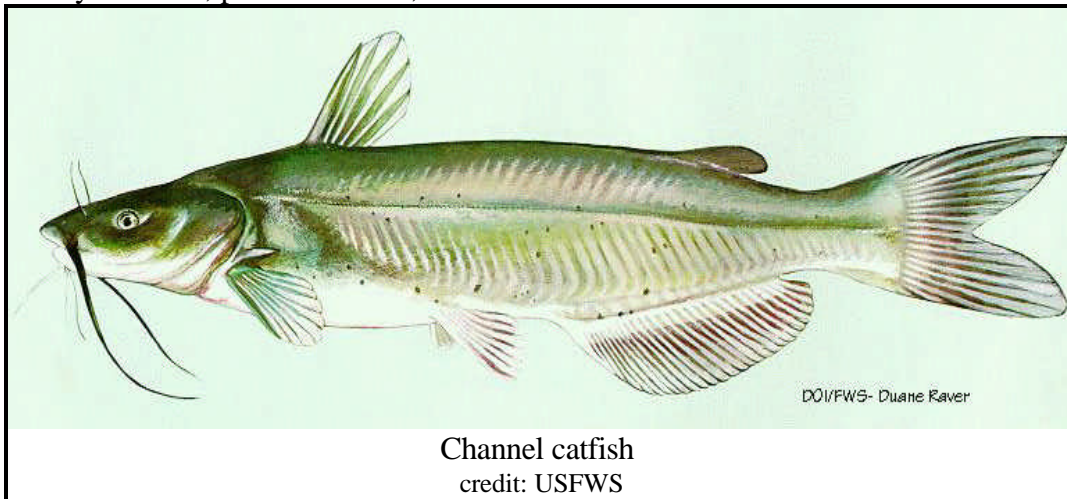
The presence of about 30 reptile species is known or inferred at DeSoto, including seven turtles, three skinks, and 21 species of snakes. At least ten species of amphibians have been observed on the refuge, including two species of salamanders, three toads, and five species of frogs.

Appendix E lists them by species. Scores of butterfly species seen at DeSoto are also included in Appendix E.



Fish – There are two main communities of fish that occur on DeSoto Refuge – those species that occur in DeSoto Lake, many of which are stocked for their sport-fishing qualities, and the naturally-occurring riverine species that are found in the Missouri River where it cuts across the refuge. DeSoto Lake contains a number of stocked game fish species, including largemouth and white bass, black and white crappie, channel and flathead catfish, bluegill, green sunfish, walleye, and northern pike. Among the rough-fish whose populations have grown in recent years are carp, buffalofish, and gizzard shad. Gizzard shad dominate the lake's biomass and are undoubtedly providing a considerable food source for predator fish. A complete list of the species collected and caught in DeSoto Lake is presented in Appendix E.

More than 80 species of fish are found in the lower Missouri River and may possibly occur within the reach that bisects DeSoto Refuge, including one or more species of sturgeons, gars, chubs, carp, shiners, catfishes, basses, crappies and minnows. These are shown in Appendix E. While only the pallid sturgeon is listed at this time, a number of other native species are considered to be in trouble due to the environmental changes in the Missouri mentioned above. The sicklefin chub and the sturgeon chub are both candidate species for federal listing and six others are considered species of concern: the lake sturgeon, paddlefish, flathead chub, western silvery minnow, plains minnow, and blue sucker.



Threatened and Endangered Species — There are no year-round resident federally threatened or endangered species at DeSoto NWR. However, three federally threatened/endangered bird species do visit the refuge ranging from regularly to infrequently: the bald eagle, least tern, and piping plover. The federally endangered peregrine falcon is but a rare visitor to DeSoto.

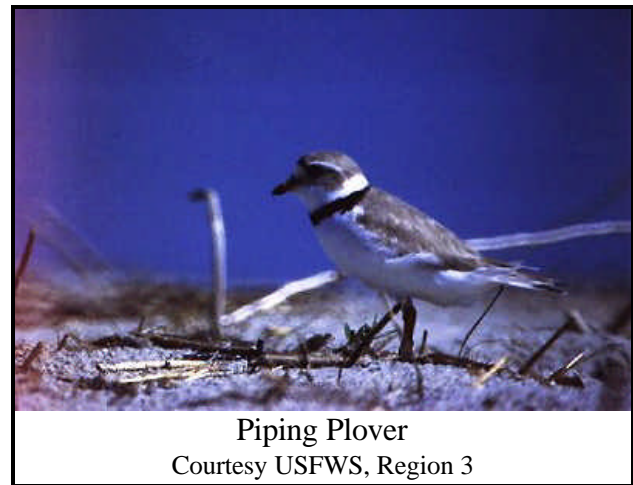
- , The **bald eagle** (*Haliaeetus leucocephalus*) is a threatened species. It is a common visitor in the fall and spring months but has never successfully nested on the refuge. By the 1950s and 1960s, a combination of poaching, habitat loss, and pesticide poisoning had sent bald eagle numbers in the Lower 48 states into a tailspin. However, since the bald eagle was fully listed under the Endangered Species Act (ESA) in 1978, the number of nesting pairs and their productivity (fledglings per nest) have increased dramatically, from a low of about 1,000 to almost 6,000 today. The bald eagle is now thriving due to



the ban on DDT and other persistent insecticides and the protection and management provided by the ESA. To recognize this momentous achievement, the Service proposes to remove the bald eagle from the threatened and endangered species list entirely.

The **least tern** (*Sterna antillarum*) interior population is an endangered species. Least terns used to nest on the refuge as recently as the 1970s but are now observed only sporadically. Dams, reservoirs, and other changes to river systems, including the Missouri, have eliminated most historic least tern habitat. The wide, braided channels dotted with sandbars that are preferred by the terns have been replaced by narrow, forested river corridors.

The **pipin plover** (*Charadrius melodus*) is also a federally listed endangered species. It too used to nest at DeSoto Refuge until the 1970s. As many as 100 individuals and 20 plover nests were documented in the mid-1960's. The last pipin plover observed at DeSoto was in 1977. It is in trouble because of habitat loss/degradation and nest disturbance and predation. Many of the beaches traditionally used by pipin plovers for nesting have been lost to development, and regulated water releases from dams have provided too much water or too little. In addition, pipin plovers are very sensitive to the presence of humans. Too much disturbance from people or their pets causes the parent birds to abandon their nest.



A sand dune along the southwest shore of DeSoto Lake was utilized by nesting terns and plovers until encroaching vegetation crowded them out in the mid-1970

In addition to the above three federally protected birds, one endangered fish — the **pallid sturgeon** (*Scaphirhynchus albus*) — is found within the Lower Missouri ecosystem, though it is scarce. Its presence within the short reach of the Missouri flowing through the refuge is unlikely, but possible. All of the more than 3,300 miles of riverine habitat within the pallid sturgeon's range have been adversely affected by man. Approximately 28 percent has been impounded, which has created unsuitable lake-like habitat; 51 percent has been channelized into deep, uniform channels; the remaining 21 percent is downstream of dams which have altered the river's hydrograph, temperature and turbidity. Commercial fishing and environmental contaminants may have also played a role in the pallid sturgeon's decline. DeSoto Refuge staff have practically no opportunity to aid in the recovery of the pallid sturgeon short of re-connecting DeSoto Lake with the river. Such action might allow this species to spawn in the re-established backwater area.



Table 1 lists threatened and endangered species that are known to occur or potentially occur in the vicinity of DeSoto National Wildlife Refuge.

**Table 1 — Threatened and Endangered Species
reported in the vicinity of DeSoto National Wildlife Refuge**

Species	Federal		State*	
	Endangered Threatened		Endangered	Threatened
Bald Eagle (<i>Haliaeetus leucocephalus</i>)		X	X	
Interior Least Tern (<i>Sterna antillarum</i>)	X		X	
Piping Plover (<i>Charadrius melodus</i>)	X			X
Peregrine Falcon (<i>Falco peregrinus</i>)	X		X	
Northern Harrier (<i>Circus cyaneus</i>)			X	
Red-shouldered Hawk (<i>Buteo lineatus</i>)			X	
Long-eared Owl (<i>Asio otus</i>)				X
Short-eared Owl (<i>Asio flammeus</i>)			X	
Henslow's Sparrow (<i>Ammodramus henslowii</i>)				X
Lake Sturgeon (<i>Acipenser fulvescens</i>)				X
Pallid Sturgeon (<i>Scaphirhynchus albus</i>)	X		X	
American Ginseng (<i>Panax quinquefolium</i>)				X

*Nebraska and/or Iowa (highest ranking between them)



Land Use and Zoning

DeSoto NWR is located in one Nebraska and two Iowa counties with primarily agricultural land use. The portion of the refuge (4,615 acres, or 59%) in Washington County, Nebraska, is zoned A-1, agriculture/farming, a category which includes forest and conservation areas as well as public parks and certain other outdoor recreation facilities. The portion (2,582 acres, or 33%) in Harrison County, Iowa, is zoned C-1, Conservation District, a category which includes parks, outdoor recreation areas and conservation reserves. Finally, the portion (626 acres, or 8%) in Pottawattamie County, Iowa, is zoned A-1, open space and conservation. The Zoning Departments of all three counties consider the refuge to be consistent with their land use plans.

Within the 7,823-acre refuge itself, at the present time, approximately 40 percent of the refuge is wooded, 25 percent is cultivated cropland (including fallow areas), 20 percent is grassland, 10 percent is DeSoto Lake, and the remaining five percent a combination of the Missouri River, wetlands, and developed sites (roads, parking lots, buildings, etc). Figure 3 is a refuge map showing current land uses. In the coming years, as cropland is retired, the percentage of that land use will decline and those of woodlands and grasslands will increase.

Contaminants and Water Quality

DeSoto Lake has had ongoing problems with water quality, both because of runoff laced with fertilizers, sediments, and pesticides from the agricultural land uses that predominate in the 12,000-acre upstream drainage basin of the lake and because of the high concentrations of fish and waterfowl that live in or use the lake. High inputs of organic substances and nutrients push the lake toward eutrophication, two symptoms of which are low dissolved oxygen (DO) and summer algal blooms. Low DO in DeSoto Lake has caused fish kills occasionally (though less frequently in recent years). Algal blooms also reduce oxygen, interfere with other more desirable aquatic organisms, and are aesthetically unattractive in and of themselves. Fish kills from low DO led to the installation of an artificial aeration system in 1985, which has helped reduce the severity of the problem.

In addition to low DO, the lake has also suffered from high turbidity (poor water clarity), which is believed to be a function primarily of rough-fish stirring up and re-suspending bottom sediments. Two other causes are from erosion of exposed lakeshores and suspended sediments transported to the lake by drainage ditches. Turbidity in turn interferes with photosynthesis and the survival of submerged and emergent vegetation. After DeSoto Lake was “renovated” in 1985, water quality was excellent and submerged aquatic vascular plants covered an estimated 700 acres of the lake bottom. Such vegetation not only added oxygen to the water but provided aquatic habitat structure beneficial to fish populations.

As well as the very tangible, visible problems with dissolved oxygen and turbidity, there are more hypothetical concerns over whether toxins — primarily residues of pesticides used in agriculture — could be contaminating the lake’s water, accumulating in sediments, and through the phenomenon of bio-magnification, accumulating to even higher concentrations in the flesh of



FIGURE 3 INSERTED HERE



fish and the creatures that feed on fish. A limited amount of sampling and testing for pesticides in the lake has been conducted, such as for the herbicide atrazine (used in corn production to control weeds, and slightly to moderately toxic to animals), which has detected chronic concentrations at low levels. In general, the replacement of persistent pesticides like DDT and other organochlorines with shorter-lived organophosphates and carbamates over the last thirty years has reduced the problem of long-term pesticide residue accumulation.

Socioeconomic Environment

Because it straddles the present Missouri River channel as well as the historic one, DeSoto NWR is located in three counties and two states: Harrison and Pottawattamie counties, Iowa and Washington County, Nebraska. The refuge is located about midway between Missouri Valley, Iowa, and Blair, Nebraska along U.S. Highway 30, which abuts its northern edge. Interstate 29, five miles to the east, is a major route from central Canada to Omaha, Nebraska and Kansas City, Missouri. Interstate 80/680, a trans-continental route, is eight miles southeast.

Harrison County, Iowa is a largely rural county with a substantial farming presence. Its 1998 population was estimated at about 15,360, up 4.3 percent from the 1990 population of 14,730. The population is about 99 percent white. The Census Bureau estimated the median household income at \$27,000 in 1993 (compared to \$28,900 for Iowa as a whole), with 12.6 percent of the population living below the poverty line (against an 11.1 percent average for the state). By 1995, Census estimated that Harrison County's median household income had risen to about \$30,100 and its poverty rate declined to 11.2 percent. In terms of the labor force, 17 percent are managerial or professional; 26 percent are technical, sales, and administrative support services; 16 percent are in farming, forestry and fishing; 11 percent are precision production, craft and repair; and 17 percent are operators, fabricators, and laborers.

Washington County, Nebraska is also a largely rural county with a large farming presence. It's 1998 population was estimated at about 18,660, up 12.4 percent from the 1990 population of 16,600. The population is about 99 percent white. The Census Bureau estimated the median household income at \$36,500 in 1993 (compared to \$29,000 for Nebraska as a whole), with 6 percent of the population living below the poverty line (against a 10.7 percent average for the state). By 1995, Census estimated that Washington County's median household income had risen to about \$40,800 and its poverty rate declined to 5.1 percent. Thus, it can be seen that Washington County is slightly more populous and affluent than Harrison County, and slightly more affluent than Nebraska overall. Harrison County, in contrast, is slightly less affluent than Iowa as a whole.

With approximately 7,000 residents, the town of Blair is the largest in Washington County, as well as the county seat. It is also the Nebraska settlement closest to DeSoto Refuge. In 1993, the fortunes of Blair and Washington County received a boost when Cargill, Inc. built a \$200 million wet corn-milling facility in town. This plant underwent a \$97 million expansion in 1995.



About eight percent of DeSoto Refuge, the southeastern corner, falls into Pottawattamie County, Iowa. This county includes the town of Council Bluffs, directly across the Missouri River from Omaha, Nebraska. The 1999 estimated population of Pottawattamie County was 86,425, about two-thirds of whom live in Council Bluffs, where the largest employers are casinos, an insurance company, and two hospitals. Over 95 percent of the county is non-Hispanic white. The Census Bureau estimated the median household income at just over \$30,000 in 1993 (revised to \$33,155 in 1995), with 12.5 percent of the 1993 population living below the poverty line. Overall, agriculture is a much smaller part of the economy and way of life in Pottawattamie County than in either Harrison or Washington counties.

Spending associated with wildlife observation, hunting, and fishing generates a substantial amount of economic activity across the United States, and DeSoto National Wildlife Refuge is no exception. Visitors to DeSoto spend money on a wide variety of goods and services, including food, lodging, transportation, outdoor apparel, binoculars, cameras, film, ammunition, and fishing tackle. Using data from the *1996 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation* and techniques developed by outdoor recreation economists and refined by the U.S. Fish and Wildlife Service's Division of Economics, it is possible to derive preliminary estimates of the economic benefits of DeSoto Refuge to surrounding communities. Total annual expenditures related to DeSoto visitation are approximately \$6.8 million, of which about 98% is from wildlife-watching. This spending in turn generates economic activity — increased output, jobs, income, and tax revenue — throughout the local and regional economy. The total annual industrial output from DeSoto is estimated at \$11.7 million; this is associated with approximately 190 jobs, \$3.2 million in annual job income, \$340,000 in state sales tax revenue, and \$121,000 in state income tax revenue.

To these economic benefits can be added three others: 1) about \$855,000 in DeSoto's annual payroll to approximately 20 employees, which generates additional economic activity from purchases in the local and regional economy; 2) tens of thousands of dollars of purchases of materials, equipment, and services from local suppliers; and 3) crops grown on the refuge by cooperating farmers valued at approximately \$206,000 annually. Total annual federal government expenditures at DeSoto Refuge (i.e. its budget of about \$1.2 million, or the sum of categories 1 and 2) lead to a direct output of approximately \$1.1 million, total output of \$1.9 million, 43 total jobs and total employee compensation of about \$1.1 million within the local and regional economy.

DeSoto's agreements with local farmers stipulate leaving one-third of the harvest for the refuge to use for waterfowl and wildlife feeding. After reimbursements to various cooperators, any excess grains are transferred to other Fish and Wildlife Service field stations by means of inter-elevator grain transfers. These grain transfers are used as wildlife food supplements. Contributions have averaged \$103,000 annually in recent years, and went to Agassiz, Big Stone, Shiawassee, Swan Lake, Tamarac, Upper Mississippi, and Necedah in Region 3; Erie, Blackwater, and Great Swamp in Region 5; and Kulm WMD, Lake Andes, Fort Niobrara-Valentine, and National Elk in Region 6.



Cultural Resources

Cultural Resources Background and Potential — Responding to the requirement in the National Wildlife Refuge System Improvement Act that Comprehensive Conservation Plans will include “the archaeological and cultural values of the planning unit,” the Service determined that available information is sufficient to provide a useful summary within the CCP.

Cultural resources are “those parts of the physical environment — natural and built — that have cultural value to some kind of sociocultural group ... [and] those non-material human social institutions....” (King, p.9). Cultural resources include historic sites, archeological sites and associated artifacts, sacred sites, traditional cultural properties, buildings and structures, and cultural items (human remains, funerary objects, sacred objects, and objects of cultural patrimony) (McManamon, Francis P. DCA-NPS; letter 12-23-97 to Walla Walla District, Corps of Engineers). Historic properties are those sites, objects, structures and districts eligible for or listed on the National Register of Historic Places. Most cultural resources are considered eligible for the National Register until determined to be ineligible.

As of May 1, 2000, Harrison and Pottawattamie counties in Iowa and Washington County in Nebraska contain 27 properties on the National Register of Historic Places. One is the *Bertrand* site and collection on DeSoto Refuge. The others are not in the vicinity of the refuge and are likely not representative of cultural resources on the refuge.

DeSoto Refuge contains 13 reported or surmised cultural resources sites, all of which are historic period Western culture sites. Just under 200 acres of the refuge have been subjected to archeological survey. Historical and geological evidence and assumptions indicate the shifting Missouri River has erased all prehistoric and most historic period archeological sites that may have existed within the Refuge boundaries; although the Iowa State Historic Preservation Officer criticized the 1978 Blakeslee survey for not including subsurface testing for buried occupation layers.

While this CCP does not propose any permanent or substantial development and excavation, should these be needed in the future, requisite archaeological studies and surveys in accordance with the National Environmental Policy Act, National Historic Preservation Act, and state laws will be carried out.

Ten Indian tribes have expressed interest in the three counties, and thus potentially on the Refuge. As tribes, their special and legal concerns would be for traditional and cultural properties, sacred sites, and cultural items. The ten tribes are the Iowa Tribe of Kansas and Nebraska, the Iowa Tribe of Oklahoma, the Kickapoo Tribe in Kansas, the Omaha Tribe of Nebraska, the Otoe-Missouria Tribe of Oklahoma, the Prairie Band of Potawatomi, the Sac & Fox Nation of Oklahoma, the Sac & Fox Tribe of Missouri, the Sac & Fox of the Mississippi, and the Winnebago Tribe of Nebraska. These ten tribes need to be invited to consult on undertakings and archeological permits that could involve their interests.

Other local organizations that could have an interest in cultural resources on the Refuge and that



should be contacted as part of consultation for undertakings are the Harrison County Historic Preservation Commission, the Harrison County Historical Society, and the Historical Society of Pottawattamie County.

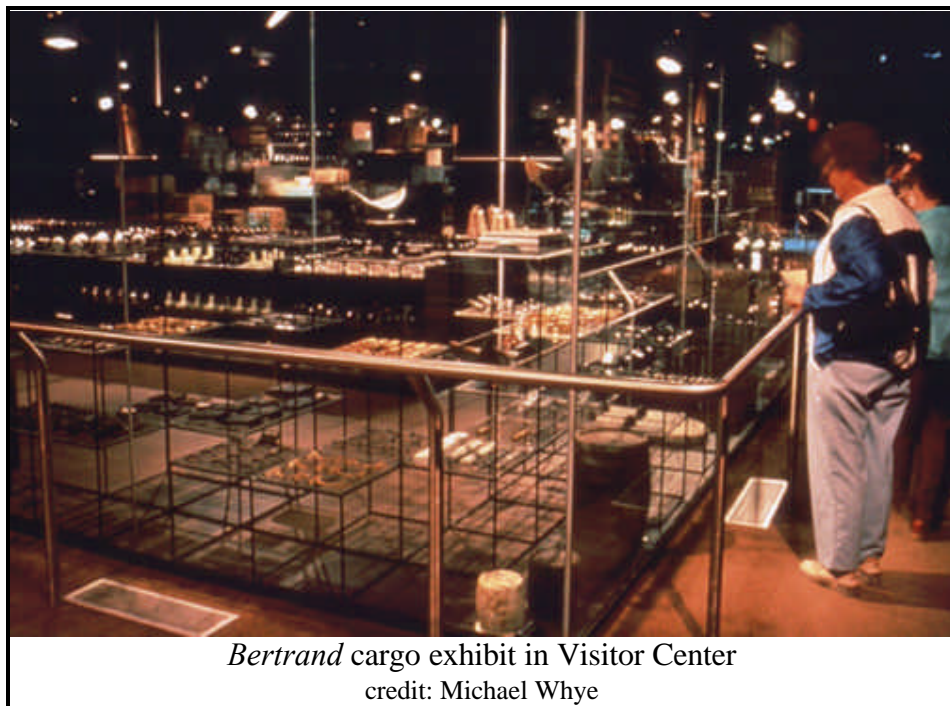
The Steamboat *Bertrand* Collection — DeSoto NWR's Visitor Center is home to a premier archaeological collection of 200,000 artifacts excavated from the buried hull of the Steamboat *Bertrand*. In 1865, the year the Civil War ended, the *Bertrand* was bound for the newly discovered goldfields of Montana from St. Louis, Missouri. It hit one of the many snags, or submerged logs, for which the Missouri was notorious, about twenty miles north of Omaha, Nebraska. The *Bertrand* sank into the depths of the river, its cargo a complete loss. Local legend indicated the ship carried whiskey, coins and 500 flasks of mercury to be used in the mining process, a veritable treasure trove worth hundreds of thousands of dollars.

"...taking a steamboat up the Missouri was one of the most precarious undertakings in the history of navigation. What any pilot may have learned about the river on his last boat trip, or even yesterday, was of no use to him today."

--Bernard DeVoto
Across the Wide Missouri, 1948

The Steamboat *Bertrand* was originally owned by J.J. Roe and Company of Saint Louis, Missouri. Roe and his partners developed the Idaho and Montana Transportation Line to move supplies up the Missouri River to newly created Fort Benton in the Montana Territory. The first steamboats arrived in the Fort Benton area by 1859. In the 1860's, goldstrikes in modern day Idaho and Montana opened the floodgates of migration to that area from the States. Prospectors and settlers created the demand to send steamboats carrying large shipments of supplies to these once sparsely populated places. Merchants learned fast that more easily acquired wealth could be had from the pockets of miners, rather than toiling to discover some elusive gold veins. Although the two-month river journey from St. Louis to the Territory was treacherous, a single successful shipment might earn as much as the value of the boat itself. In any event, most of the materials on the *Bertrand* were insured.

Using historical documents and a flux gate magnetometer, modern salvors discovered the wreck on DeSoto Refuge in 1968. Since the boat's hull was on federal government property, the salvors agreed, under the requirements of the American Antiquities Preservation Act of 1906, to hand all manmade artifacts over to the U.S. Fish and Wildlife Service for permanent exhibition and preservation in a public museum. By 1969, the *Bertrand* had been completely excavated from its 30-foot deep, mud tomb under the auspices of National Park Service archaeologists.



Bertrand cargo exhibit in Visitor Center
credit: Michael Whye

Unfortunately for the salvors, the treasure they sought had eluded them. Insurance company divers had removed most of the mercury and other valuables way back in 1865. Nevertheless, an extraordinary array of tools, clothing, food, and equipment remained in the hull. These materials were in remarkably good condition, having been preserved in an anaerobic, only slightly acidic, medium. The collection is a treasure trove of another sort for researchers and historians who normally find only bits and pieces of material culture at archeological sites.

Stabilization of the fragile cargo of the *Bertrand* began before the excavation was completed. Temporary storage and conservation labs were constructed to minimize further deterioration of objects made of fabric, leather, wood and metal. Conservation techniques were developed by trial and error. In the meantime, construction of the Visitor Center was begun to provide more sophisticated, controlled environments and conservation facilities. Today those artifacts are somewhat secure in the Visitor Center. However, deterioration never completely stops and re-application of conservation processes is an ongoing necessity. Limited budgets and manpower have resulted in maintenance backlog for the *Bertrand* Collection.

The Visitor Center houses artifacts from the Steamboat *Bertrand*. Many of the goods are not what one would expect to find in the rough-and-tumble mining towns of the nineteenth century American frontier. Apart from the necessities of clothing, tools, and food, the cargo also included olive oil and mustard from France, bottled tamarinds and a variety of canned fruits, several varieties of alcoholic beverages called bitters, and powdered lemonade in a can. Some consignees even ordered brandied cherries, not the kind of inventory one would associate with merchants on the U.S. frontier. The *Bertrand* Collection reflects the long history of Americans' predilection for the finer things in life.



A state-of-the-art, collection storage area protects the cargo of the boat. Visitors may view this area through a glass wall, 150 feet in length. A conservation lab for artifact preservation, collection research area and library, are staffed by museum professionals. The center also contains a theater and exhibition galleries. Permanent exhibits discuss the impact steamboat cargoes and passengers had on the frontier through town-building, farming, logging and mining. From the outset, each of these pursuits, while laying the foundation for prosperity and growth, also produced long-term adverse effects upon Native American inhabitants, the environment and wildlife habitats. Exhibits address the history of wildlife refuges, which were created to help conserve and restore wildlife. Temporary exhibits include a variety of topics from art shows to interpretive programs.

Public Use

Visitation and recreation by the public are encouraged on national wildlife refuges for activities that are compatible with the refuge purpose and mission. There are six priority, wildlife-dependent public uses: wildlife observation, photography, environmental education, interpretation, hunting, and fishing. DeSoto National Wildlife Refuge has all of these.

DeSoto NWR is one of the more heavily visited national wildlife refuges. In the 1960s visitation averaged about 197,000 per year. In the 1970s the annual average climbed to 341,000 per year, and in the 1980s it rose yet again to 396,000, with a single year peak of 473,038 visitors in 1982. From 1990 to 1999 (the most recent year for which figures are available), visitation dropped somewhat to an annual average of 295,000. Refuge staff attribute this decline in visitation to several factors:

- < Swimming, high-speed boating and water skiing were all banned from DeSoto Lake in the 1980s. This led to a decline in the number of summertime recreationists participating in these intensive activities. These uses were judged incompatible with the refuge purpose and mission; they are also not wildlife-dependent.
- < The imposition of an entrance fee in 1987 appears to have discouraged a number of former and prospective users.
- < Other entities have begun providing outdoor recreational, nature observation, and fishing opportunities in the region over the last couple of decades.
- < In the last several years, annual visitation has dipped well below 300,000, due in good part to excessive water levels in DeSoto Lake which limited public access by flooding facilities like parking lots, boat ramps, and trails.

The great preponderance of visitors to DeSoto come to observe wildlife and to partake of the interpretive opportunities in the Visitor Center, with smaller numbers coming for environmental education, hiking/walking, fishing, and hunting. November is usually the busiest month of the year, coinciding with the fall snow goose and waterfowl migration. Visitor Center staff estimate



that about 50 percent of visitors are non-resident, that is, they come from more than an hour's drive away. (By this definition, visitors from Omaha, Nebraska, the nearest large city, would qualify as resident.) In 1999, the registration book recorded people from all 50 states and Puerto Rico. DeSoto attracts an impressive variety of foreign visitors. In 1999, they came from Nepal, Czechoslovakia, Ecuador, Japan, Germany and nearly 50 other nations.

Table 2 below displays visitation for fiscal year 1999, broken down by activity. Using a different breakdown, in FY 1995, there were 309,300 visitor days in total, 141,100 visitor days at the Visitor Center, 248,100 visitor days for nature trails, 700 visitor days for hunting, and 5,700 visitor days for fishing. (The total does not equal the sum of the separate activities because of multiple-purpose visits.)

Table 2
FY 1999 Comparative Visitation to DeSoto National Wildlife Refuge

Activity	1999 Visits	Activity Hours
Interpretation	472,396	240,930
Environmental education	8,227	24,927
Consumptive wildlife recreation (hunting, fishing)	10,777	31,079
Non-consumptive wildlife-related recreation	218,502	148,662
Non-wildlife recreation	4,478	2,237
Total activity hours		447,835



Special Management Topic

Wilderness Review

As part of the CCP process, lands within the legislative boundaries of DeSoto National Wildlife Refuge were reviewed for wilderness suitability. No lands were found suitable for designation as Wilderness as defined in the Wilderness Act of 1964.

DeSoto NWR does not contain 5,000 contiguous roadless acres, nor does the refuge have any units of sufficient size to make their preservation practicable as Wilderness. The lands of the refuge have been substantially affected by humans, particularly through agriculture and regulation of the Missouri River. As a result of both extensive modification of natural habitats and ongoing manipulation of natural processes, adopting a “hands-off” approach to management at the refuge *per se* would not facilitate the restoration of a pristine or pre-settlement condition, which is the goal of wilderness designation.



Morel mushroom
credit: John Jave

